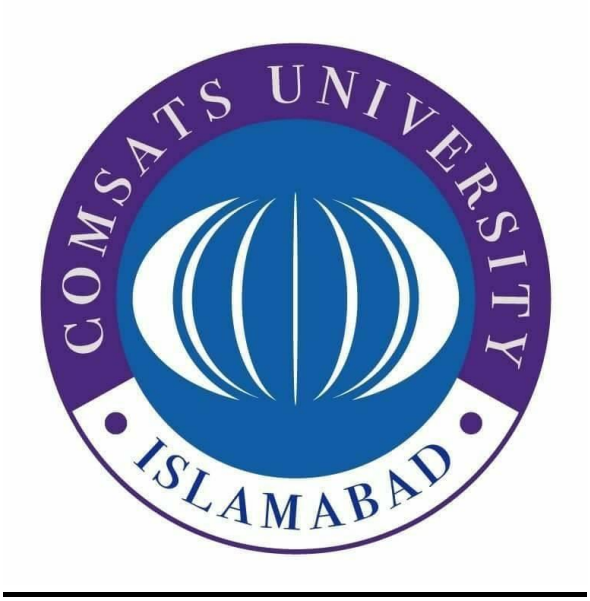
ARTIFICIAL INTELLIGENCE

(CSC 462)

ASSIGNMENT # 2



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CLASS & SECTION: BSSE-5A

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QUESTION 1

1. Network Routing Optimization:

Problem: Determine the optimal paths for data packets to be transmitted through a computer network, minimizing latency and maximizing throughput.

Representation: A set of routes or paths through the network nodes.

Initial Population: Randomly generated sets of network routes.

Evaluation Function: The total latency or time taken for data packets to travel through the network.

Mutation: Alter or reconfigure certain nodes or links in the routes.

Crossover Procedure: Uniform Crossover, where paths are exchanged between two parent solutions to create offspring routes.

Exit Criteria: When a specified level of network efficiency is achieved or after a certain number of generations.

2. Feature Selection in Machine Learning:

Problem: Select the most relevant features from a given dataset to improve the performance of a machine learning model.

Representation: A binary vector where each element represents the presence or absence of a feature.

Initial Population: Randomly generated binary feature vectors.

Evaluation Function: The performance metric (e.g., accuracy, F1-score) of the machine learning model trained on the selected features.

Mutation: Flip the value of a feature (i.e., include/exclude a feature).

Crossover Procedure: One-Point Crossover for binary vectors to exchange feature subsets between parent solutions.

Exit Criteria: When the machine learning model achieves a satisfactory level of performance or after a certain number of generations.

3. Inventory Management in Supply Chain:

Problem: Determine the optimal inventory levels for various products in a supply chain network to minimize holding costs while meeting customer demand.

Representation: A set of integers representing the inventory levels for different products.

Initial Population: Randomly generated sets of inventory levels for products.
Evaluation Function: The total cost incurred, considering holding costs and penalties for stockouts.
Mutation: Adjust the inventory levels for specific products.
Crossover Procedure: Blend Crossover for integer variables, blending the values of parent solutions to create offspring inventory levels.
Exit Criteria: When a certain cost threshold is reached or after a certain number of generations.

QUESTION 2

1. **Initialization:**
   Create an initial population of potential solutions (chromosomes). Each chromosome represents a placement of queens on the chessboard.
   Define a fitness function that evaluates how good a solution is. In this case, it should penalize solutions where queens threaten each other.
2. **Selection**
   Use a selection method (e.g., roulette wheel selection, tournament selection) to choose parents from the population based on their fitness.
3. **Crossover**
   Apply crossover (recombination) to the selected parents to create new offspring chromosomes. This combines the genetic material of two parents to create one or more children.
4. **Mutation**
   Apply mutation to the offspring. This introduces small random changes to the chromosomes. In this context, mutation might involve randomly moving a queen to a different position.
5. **Evaluate Fitness**
   Evaluate the fitness of the new offspring generated through crossover and mutation.
6. **Survivor Selection**
   Select the next generation from the current population and the offspring. This can be done using methods like elitism (keeping the best solutions) or generational replacement.
7. **Termination Condition**

Check if a termination condition is met. This could be a maximum number of generations reached, or a solution with adequate fitness is found.

8. **Repeat**
   If the termination condition is not met, repeat steps 2 through 7 until a satisfactory solution is found.

START

[0,1,5,6,0,2,6,5]

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
0	Q				Q			
1		Q						
2						Q		
3								
4								
5			Q					Q
6				Q			Q	
7								

[7,1,5,6,0,2,6,5]

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
0					Q			
1		Q						
2						Q		
3								
4								
5			Q					Q
6				Q			Q	
7	Q							

[7,1,4,6,0,2,6,5]

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
0					Q			
1		Q						
2						Q		
3								
4			Q					
5								Q
6				Q			Q	
7	Q							

[7,1,4,2,0,2,6,5]

	0	1	2	3	4	5	6	7
0					Q			
1		Q						
2				Q		Q		
3								
4			Q					
5								Q
6							Q	
7	Q							

[7,1,4,2,0,6,6,5]

	0	1	2	3	4	5	6	7
0					Q			
1		Q						
2				Q				
3								
4			Q					
5								Q
6						Q	Q	
7	Q							

[7,1,4,2,0,6,3,5]

	0	1	2	3	4	5	6	7
0					Q			
1		Q						
2				Q				
3							Q	
4			Q					
5								Q
6						Q		
7	Q							

QUESTION 3

1)

	Variables	Initial Domains
Algorithms Requirement (AR)	10, 11, 12, 13, 15	10, 11, 12, 13, 15
Machine Learning Requirement (MLR)	12, 13, 15	12, 13, 15
Communications Requirement (CR):	15, 17, 16	15, 17, 16
ICT Requirement (ICTR)	12, 18	12, 18

2)

Algorithms Requirement (AR):

If Mateen has already taken 10, then domain of AR: {11, 12, 13, 15}
If Mateen has already taken 11, then domain of AR: {10, 12, 13, 15}
If Mateen has already taken 12, then domain of AR: 10, 13, 15}
If Mateen has already taken 13, then domain of AR: {10, 12, 15}
If Mateen has already taken 15, then domain of AR: {10, 11, 12, 13}

Machine Learning Requirement (MLR):

If Mateen has already taken 12, then domain of MLR: {13, 15}
If Mateen has already taken 13, then domain of MLR: {12, 15}
If Mateen has already taken 15, then domain of MLR: {12, 13}

Communications Requirement (CR):

No constraints are applied based on what Mateen has taken.

ICT Requirement (ICTR):

If Mateen has already taken 12, then domain of ICTR: {18}.
If Mateen has already taken 18, then domain of ICTR: {12}.

Schedule:

Based on the constraint propagation, Mateen can select the following classes to satisfy all requirements:
AR: 10
MLR: 12
CR: 15
ICTR: 18